Statistical Physics of Information Measures

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Abstract

The talk focuses on several aspects of the interplay between statistical mechanics and information measures, like the relative entropy and the mutual information, which are among the most fundamental notions in information theory. After a brief background, the talk will be divided into two parts: In the first, it will be shown that the information inequality and the data processing theorem of the mutual information, which set the stage to most, if not all, fundamental limits of information theory, are intimately related to the second law of thermodynamics – one of the fundamental limits of Nature. The second part of the talk will be devoted to the use of statistical–mechanical tools for analyzing the mutual information in coded communication systems. In particular, threshold effects and irregularities in the behavior of these systems will be shown to have intimate relations to phase transitions in the corresponding physical systems.